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*by Frieder Frasch**

## Introduction

Recently published scientific studies, such as the Stern-Report[1] and the Fourth Intergovernmental Panel on Climate Change ("IPCC") Assessment Report,[2] illustrate the dire need to curb carbon dioxide ("$CO_2$") emissions in order to combat global climate change. As a result, climate change mitigation has become a cornerstone of European energy policy and is becoming increasingly important in the United States.[3] European leaders have agreed on ambitious targets, including a twenty percent $CO_2$ emission reduction from 1990 levels by 2020. In view of these European commitments and the nascent carbon emissions trading regimes underway in the United States, it is worthwhile to inspect the efficiency of European Union Emissions Trading Scheme ("EU ETS"), the central instrument of European climate policy. This paper presents an empirical analysis of the corporate transaction costs from three German companies obligated to take part in the EU ETS. The data presented in this article are among the first systematically surveyed results in Europe. Under inspection, these costs vary widely by companies participating in such regimes and can differ by a factor of five.

The information presented in this article helps identify optimization potential within the German implementation of this Emissions Trading Scheme and assist in the design of sound emission trading systems in the United States or elsewhere. As a result, the countries' energy policies will be better suited to fulfill energy needs with a reduction in greenhouse gases.

## Transaction Costs

In this article, the term transaction cost is not restricted to search, negotiation, and decision-making costs. It is used here in a wider sense to include information and opportunity costs beyond those directly associated with a good's transaction. Simplified, all costs that arise in the course of administration and management of the emissions trade are considered transaction costs, excluding purchasing or abatement costs (See Table 1). Generally all transaction costs are "deadweight losses," as expenditures for the obligations of the emissions trade cannot be used to realize emission abatement measures.

Macroeconomic theory states that transaction costs hinder the cost-effective allocation of tradable permits as the volume traded decreases, which results in an increase of macroeconomic abatement costs.[4] However, this aspect is of less importance since a significant proportion of the transaction costs associated with the EU ETS arises with non-trade related activities; therefore, the effect on trade volume is not as significant as new institutional economics would expect.[5]

Transaction costs are influenced by the frequency, asset specifics, and uncertainty of the transaction.[6] All these factors are to some degree interrelated with the implementation of the EU ETS but depend mainly on the size and the type of company participating in the system.[7] For instance, it can be expected that a pulp and paper company will have higher costs to develop a trading strategy than a large utility actively engaged in electricity trade due to the necessary expertise already being developed in the utility sector.

## EU Emissions Trading In Germany

The European Emissions Trading Directive 2003/87/EG[8] defines the structural elements of the ETS. As an EU Directive, it must be implemented into national law in all EU member countries. In Germany, the Directive was implemented through two laws and two ordinances.[9] The first, the Greenhouse Gas Emissions Trading Act ("TEHG") is composed of six sections defining the ETS framework and how the system functions. The first section of the Act defines the aim, the criteria for participation in the system (defined as installations, or sources, with a generation capacity greater than 20 MWh), and the central terms of the scheme. The second section requires affected companies to properly monitor their emissions and to have a permit to run the installation. The third section of the TEHG sets forth the terms implementing the national allocation plan and sets allocation rules. The terms of the actual emission trade are defined in the fourth part. The fifth and sixth parts contain sanction mechanisms, assign jurisdiction to the German Emissions Trading Agency ("DEHSt"), and define additional formal requirements.

The Allocation Law of 2005-2007 and the Allocation Ordinance of 2005-2007 govern the allocation for the first commitment period from 2005 to 2007.[10] The former outlines the allocation rules, whereas the latter contains all the technical definitions and details necessary for calculating the exact number of EU Allowances ("EUA") an installation receives.

Germany allocates emission credits to sources through a range of methods. Primarily, emission allocation is based on benchmarks or historical emissions; however, the political process has resulted in special rules for certain facilities. For instance, exceptions are made for certain efficient technologies, such as combined heat and power plants, or firms experiencing undue hardships. As a result, there is a fairly complicated set of 58 different possible combinations of allocations rules that the

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DEHSt, as the executive agency, must navigate. Thus, regulatory complexity is a main driver of transaction costs in the first commitment period. Moreover, a cost ordinance determines which fees a company has to pay to participate in the EU ETS. The TEHG specifies that participating companies must bear the cost of the DEHSt through these fees, making the administration of the EU ETS cost neutral for the German government.

Table 1 presents eight categories summarizing transaction costs facing companies participating in the EU ETS. Specifically, these costs consist of application, implementation of an emissions trading management, monitoring, reporting, abatement measures, trade related activities,[11] and development or adaptation of strategic considerations. The cost for appeals and other legal claims belong to the application category but are not analyzed in the following case studies.[12]

**TABLE 1: TRANSACTION COST CATEGORIES**

| Category | Transaction Costs |
|---|---|
| Application | • Quantification of historic emissions<br>• Development of emission outlooks<br>• Decision for an application rule<br>• Compilation of an application<br>• Where necessary, compilation of a benchmark<br>• Verification of the application<br>• Fees for annual allocation<br>• Fees for emissions register |
| Implementation of an emissions management | • Information, training<br>• Assessment of obligation to participate in the EU ETS<br>• Set up of organizational structures and assignment of responsibilities<br>• Adaptation or purchase of software<br>• Material costs |
| Monitoring | • Design of a monitoring concept<br>• Implementation of an internal monitoring system<br>• Ongoing monitoring |
| Reporting | • Quantification of annual emissions<br>• Compilation of an emissions report<br>• Verification of an emissions report<br>• Delivery of data for ex-post-control |
| Abatement measures | • Identification of abatement measures<br>• Decision about abatement measures |
| Trade | • Transactions fees (exchange fees, broker fees, clearing)<br>• Trade<br>• Market observation |
| Strategy | • Definition of a risk strategy<br>• Definition of a trade strategy<br>• Definition of a abatement strategy |

## CASE STUDIES

Case studies are well suited to analyze transaction costs, because it is possible to effectively consider unique characteristics facing the corporation that cannot be gleaned from surveys or simplistic questionnaires. For instance, observed transaction costs arise in different parts of the companies and their underlying time and cost expenditures are typically not separately recorded from other ongoing business routines. For this case study, three companies were chosen and several corporate employees interviewed in-depth after the first emissions reports were sent to the DEHSt in April 2006. The data surveyed can be considered to be precise because all information was verified by interviewees. It should be emphasized that the small sample size indicates that this data is not representative. For that reason, no aggregate figures or extrapolations are presented in this paper.

The first case study is one of the four major utilities in Germany whose twenty installations emitted about eleven million tons ("Mt") $CO_2$ in 2005. Due to the magnitude of the emissions and their direct relation to the firm's core business processes, corporate exposure to the EU ETS can be regarded as high. The company analyzed in the second case study is a typical medium-sized utility, which is active in municipal public services like water and gas supply. Its three installations are only used for district heating and reserve or peak load production. Therefore, less $CO_2$ is emitted which—in combination with the diversity of its operations—leads only to a medium exposure to the EU ETS. The third case study analyzes a major lime works company. The emissions of twelve installations add up to about two Mt $CO_2$ per year. As the added value per ton of $CO_2$ is low in mineral processing industries, emission levels result in a high exposure to the EU ETS.

**TABLE 2: CASE STUDIES**

| | Case Study 1 | Case Study 2 | Case Study 3 |
|---|---|---|---|
| | **Major Utility (MU)** | **Pubic Services Utility (PS)** | **Major Lime Works Co. (LW)** |
| Employees | 18,000 (2005) | 1,100 (2005) | 900 (2004) |
| Installations | 18 | 2 | 12 |
| Total annual EUA [t $CO_2$] | 1,000,000 | 62,000 | 2,000,000 |
| Average EUA per installation p.a. [t $CO_2$] | 600,000 | 31,000 | 150,000 |
| Reported emissions in 2005 [t $CO_2$] | 11,000,000 | 64,000 | 1,800,000 |
| Surplus/shortage 2005 | -1,000,000 | -2,000 | 200,000 |
| Exposure to EU ETS | High | Medium | High |

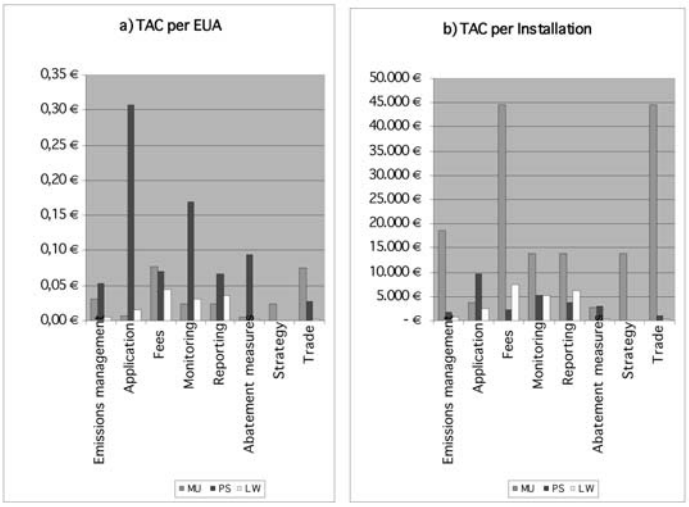
## Results

In 2006, transaction costs for the major utility ("MU") totaled 2.8 million euro, 52,000 euro for the medium-sized public services utility ("PS"), and 270,000 for the major lime works company ("LW"). One-time costs, such as setting up the necessary corporate structures, quantifying historic emissions for the application process, and verifying the applications were aggregated, and then divided by the number of years in the first commitment period and then allocated to the year 2005. The transaction costs for the compilation and verification of the first emissions report were also attributed to 2005, although they arose in 2006, to ensure accordance with a cost-accrual concept. The figures in Table 3 relate to the EUAs assigned, and not to the EUAs returned in 2005, because this would have caused inconsistencies when accruing the cost partition of one-off[13] costs to the years 2006 and 2007. In regard to the different emissions levels of the installations, the results are presented as specific transaction costs per EUA and per installation.

The specific costs per EUA differ by a factor of five, from 0.14 euro to 0.79 euro. Surprisingly, the lime works company has the lowest transactions costs, which can only be explained by relatively low expenditures for abatement, strategy, and trade. The company's emission management set-up costs have been relatively moderate, which might be a result of the company's existing environmental management system that follows similar management routines. Unlike utility companies, the lime works company participates in a competitive market place and cannot, or can only to a limited extent, pass on the additional costs from the EU ETS to their customers. This fact might also have led to greater cost-consciousness.

The major utility's transaction costs are about twice as high than the lime work company's due to high allocation fees and frequent trade activities. The public services utility bears the lowest absolute transaction costs in all categories but the highest transaction cost per allocation at 0.79 euro. A comparison of the cost figures per installation in Figure 1(b) shows that the major utility bears highest costs as a result of high average emissions of 600,000 tons $CO_2$ (See Table 2). This reflects the curbing effect of frequency on the specific transaction cost per allocation.

**Figure 1: Comparison of Transaction Costs**




An analysis of transaction cost distribution clearly shows that the one-time costs for the set-up of the emission trade are a relatively low component (between four and twelve percent of the total costs). The latter could increase by the end of the first commitment period in 2008, when companies decide to acquire software for the automation of processes. This was not an attractive option in the beginning, as compatibility definitions for the software interface with the DEHSt were not available. Therefore, companies integrated the processes of the EU ETS in their existing software environment instead of purchasing additional ones.

The application's high cost share (37 percent) for the public services utility is astonishing. The category includes cost related to initial training in the emissions trading scheme and this adds up to a rather high amount. It is likely that the cost for the orientation in the new complex policy regime is of a similar magnitude in other small companies with few installations. Obviously, these learning costs will be much lower for the next

**Table 3: Transaction Costs in 2005**

| | | Emissions management | Application | Fees | Monitoring | Reporting | Abatement | Strategy | Trade | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| EUA | MU | 0.03 € | 0.01 € | 0.08 € | 0.02 € | 0.02 € | 0.005 € | 0.02 € | 0.08 € | 0.27 € |
| | PS | 0.05 € | 0.31 € | 0.07 € | 0.17 € | 0.07 € | 0.094 € | 0.00 € | 0.03 € | 0.79 € |
| | LW | 0.01 € | 0.02 € | 0.04 € | 0,03 € | 0.04 € | 0.00 € | 0.00 € | 0.00 € | 0.14 € |
| Installation | MU | 18,519 € | 3,648 € | 44,612 € | 13,889 € | 13,889 € | 2,778 € | 13,889 € | 44,444 € | 155,667 € |
| | PS | 1,633 € | 9,583 € | 2,158 € | 5,288 € | 3,800 € | 2,917 € | 0 € | 869 € | 26,248 € |
| | LW | 857 € | 2,530 € | 7,375 € | 5,116 € | 6,073 € | 233 € | 78 € | 233 € | 22,496 € |

commitment period as companies will be familiar with the function of the EU ETS and will have experiences in trading. Similarly, fees make up around one third of total transaction in the major utility and lime works company, both enterprises with high emissions levels. This is especially negative from a corporate point of view as there are limited possibilities to internally decrease this share through efficiencies or other mechanisms. A simplified allocation scheme with fewer combinations of application rules would have decreased the costs at the DEHSt administrational level resulting in lower fees for the participants.

The share of transaction costs due to monitoring and reporting is highest at the lime works company (23 percent and 27 percent, respectively), which can be explained by more complex monitoring procedures covering a wider product range, various fuels and different productions methods. The public utility also has a high transaction cost share for those two categories (twenty percent and fourteen percent), but they can likely be accounted to the low number of installations that prevent the company from profiting from learning effects in the compilations of monitoring schemes and emission reporting.

Approximately one third (29 percent) of the transaction costs observed at the major utility originate from trading permits, which significantly differ from the other firms examined (three percent for PS, one percent for LW). This is most likely due to similarities in the core business of larger utilities that constantly optimize their power generation capacities. The high amount of allocated permits certainly enhances corporate possibilities to take advantage of the emissions trade. The permit trade is part of the day-to-day business just as much as electricity trading at the major utility, and this compliments a higher transaction cost share. Another surprising finding is the low level of transaction costs at the lime works company that cannot be explained with transaction cost theory. The higher costs at the public services utility on the other hand are in line with theoretical assumptions regarding economies of scale, as there are only two installations and relatively few EUAs allocated. The level of transaction costs at the major utility can be well explained by the more pro-active emission management and the voluminous trading activities. Apart from that it can be stated that the amount of transaction costs corresponds well with other preliminary estimates, but no extraordinarily high transaction costs of greater than one euro per EUA was found.

## Conclusion

The varying results in transaction costs should encourage companies to examine the structure of their emissions management and to look for optimization potentials. Generally, sinking transactions cost levels can be expected with increasingly amplifying learning effects, but this will not be self-evident. Usually, a simpler allocation scheme could contribute to decreasing transaction costs for the application and fees. Among the possibilities to achieve this are permit auctions or a de-minimis rule for reduced requirements for installations with low emissions level-both are currently discussed in the policy formulation phase for the second commitment period in Germany. Although the level of transaction costs overall is moderate, a decrease would be highly desirable—especially when they are compared to the current spot price of permits of about 1.50 euro.

# Endnotes: Transaction Costs

[1] *See* Nicholas Stern, Stern Review on the Economics of Climate Change (2006), *available at* http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm (last visited Apr. 16, 2007).

[2] *See* Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis, Summary for Policymakers (2007), *available at* http://www.ipcc.ch/SPM2feb07.pdf (last visited Apr. 16, 2007).

[3] *See* Regional Greenhouse Gas Initiative (RGGI), http://rggi.org/about.htm (last visited Apr. 16, 2007).

[4] *See* Robert N. Stavins, *Transaction Costs and Tradable Permits*, 29 J. Envtl. Econ. & Mgmt. 113, 113-48 (1995).

[5] *See* Douglas W. Allen, *Transaction Costs, in* The History and Methodology of Law and Economics. Encyclopedia of Law and Economics Volume I 893 (Boudewijn Bouckaert & Gerrit de Geest eds., 2000), *available at* http://users.ugent.be/~gdegeest/tablebib.htm (last visited Apr. 18, 2007).

[6] *See* Oliver E. Williamson, *Transaction Cost Economics, in* Handbook of Industrial Organization Volume I 136 (Richard Schmalensee & Robert Willig eds., 1989).

[7] *See* Ingo Puhl et al., Leitfaden Zertifikatehandel (2005), *available at* http://www.co2ncept.net/downld/Leitfaden_Zertifikatehandel_OV.pdf (last visited Apr. 2, 2007).

[8] Council Directive 2003/97/EC, Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EX, 2003 O.J. (275/32).

[9] *See* DEHSt, Emissions Trading in Germany: Allocations of Allowances for the First Commitment Period 2005-2007 (2d ed. 2005), *available at* http://www.dehst.de/cln_007/nn_941174/SharedDocs/Presse/Hintergrundinformationen/Allocation__of__Allowances,templateId=raw,property=publicationFile.pdf/Allocation_of_Allowances.pdf (last visited Apr. 16, 2007).

[10] *See* National Allocation Plan for the Federal Republic of Germany 2005-2007 (2004), *available at* http://www.bmu.de/english/emissions_trading/national_allocation_plan/doc/5894.php (last visited Apr. 16, 2007).

[11] Note, that this category comprises only the transaction costs of trading. Potential profits or losses are not taken into account in this analysis.

[12] The transaction cost categories relate partly to the framework legislation (TEHG), the allocation act (ZuG 2007) and systematics of the EU ETS.

[13] One-off costs are costs that arise only once during the first commitment period, e.g., the fee for an account in the registry at the DEHSt.